CLASSIFICATION CONFIDENTIAL CONFIDENTIAL

CENTRAL INTELLIGENCE AGENCY REPORT

INFORMATION FROM

FOREIGN DOCUMENTS OR RADIO BROADCASTS CD NO.

50X1-HUM

COUNTRY	USSR	DATE OF INFORMATION	1949
SUBJECT	Scientific - Acoustics		
HOW PUBLISHED	Bimonthly periodical	DATE DIST.	25 Apr 1950
WHERE PUBLISHED	Moscow	NO. OF PAGES	3
DATE PUBLISHED	Dec 1949		
LANGUAGE	Russian	SUPPLEMENT TO REPORT NO.	

THIS IS UNEVALUATED INFORMATION

SOURCE <u>Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya</u>, Vol XIII, No 6, 1949.

DEVELOPMENT OF WORK ON THE FOCUSING OF SOUND

L. D. Rozenberg

Soviet work on sound-focusing systems dates back to 1943 and 1944 when this problem was extensively studied in the Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR, under the direction of L. D. Rozenberg. Some detailed results of this study were presented in Rozenberg's book Sound-Focusing Systems, published by the Academy of Sciences USSR, Moscow-Leningrad. 1949.

A. A. Karpacheva, Rozenberg, and B. D. Tartakovskiy /1, 2, 3/ experimentally studied the focusing properties of a zonal plate. The studies were made in air, in a banked chamber with dimensions of 8.0 x 2.5 x 2.5 meters at a frequency of 14,000 cycles, i.e., a wave length of 2.43 centimeters. An electrodynamic radiator was used as the sonic source and a point-measuring condenser microphone of the "Krasnaya Zarya" Plant was used as the receiver. The latter was moved along three mutually perpendicular directions with the aid of a special coordinator. The rings of the zonal plates were made of wood or aluminum 2.5 millimeters thick.

A series of zonal plates was studied with a focal distance of 20 centimeters and an aperture radius varying from 18.9 (3 rings) to 45.8 centimeters (12 rings). The distribution of pressures along the axis of the plate in the focal plane and at a source located outside the main axis was studied. The chromatic aberration of the zonal plate was also investigated. G. D. Malyuzinets /4/ used the Huygens-Kirchoff hypothesis to solve the problem concerning diffraction close to the axis of the zonal plate. Further studies by Rozenberg /3/ showed that there is in a zonal plate an optimum aperture angle for which the coefficient of amplification with respect to pressure is a maximum; there is also an optimum for amplification with respect to velocity.

CLASSIFICATION CONFIDENTIAL CONFIDENTIAL

STATE	X	NAVY	X	NSRB		DISTRIBUTION		
ARMY	X	AIR	X	FBI				

ARCHIVAL RECORD
RETURN TO AGENCY ARCHIVES

CONFIDENTIAL

CONFIDENTIAL

50X1-HUM

Rozenberg also studied sound prisms and lenses [3, 5, 6]. When a long-focus lens is considered as a liquid, i.e., when bending oscillations and dissipative losses in the body of the lens are neglected, the limiting expressions for total transparency to energy, n equals $1/a$ (1), and for the coefficient of amplication, K equals $(kR^2/f)/(a+1)$ (2), are obtained, where k is the wave number, R is the radius of aperture, f is the focal distance, and a equals $\frac{1}{2}(z_1/z_2 + z_2/z_1)$, where z_1 and z_2 are the characteristic impedances of the medium and the lens material, respectively.

Expressions (1) and (2) are the limits to which the transparency and coefficient of amplification tend as the wave length tends to zero, i.e., in the case of geometrical acoustics. The use of these formulas in real systems causes errors but these errors are not large; in order of magnitude, they are equal to the ratio of the radius of the diffraction spot to the radius of the aperture.

These expressions make possible a rational approach to the selection of a material for acoustic lenses. A special diagram was suggested for this purpose. In this diagram, the modulus of elasticity is placed along the abscissa and the density is placed along the ordinate. Lines of equal transparency with respect to the same medium are depicted in the form of two families of curves, while a definite point in the density diagram corresponds to each material. The suitability of a given material for acoustic lenses can be determined immediately by the position of this point relative to the family of curves.

B. D. Tartakovskiy [7] showed that converging and diverging focusing lenses are not identical from the standpoint of spherical aberration; a considerably smaller value of spherical aberration is obtained in diverging lenses than in converging lenses. From this standpoint, acoustic focusing lenses have an advantage over optical lenses, which must always be converging since the speed of light in any lens material is always less than in air.

Using expressions which he had derived for the coefficients of amplification with respect to pressure and velocity, L. D. Rozenberg studied these coefficients for a paraboloid for the case of aperture angles greater than pi/2[3]. It was discovered that the velocity in the center of the focal spot is equal to zero in a paraboloid with optimum aperture angle. This method was also used to study short-focus lenses and elliptical mirrors, as concentrators of acoustic energy, and their coefficients of amplification and optimal dependencies were determined.

Very recently, a few qualitative studies in this field have been completed abroad and more serious works on a level already surpassed by the Soviet Union are just beginning to appear. This shows that priority unconditionally belongs to Soviet scientists in all branches of sound-focusing systems, which are obtaining everincreasing application in contemporary engineering

BIBLIOGRAPHY

1. Karpacheva, A. A., Rozenberg, L. D., Tartakovskiy, B. D., DAN, Vol LIV, 399 (1946).

2. Karpacheva, A. A., Rozenberg, L. D., Tartakovskiy, B. D., DAN, Vol LVII, 329 (1947).

3. Rozenberg, L. D., Sound-Focusing Systems, Izd-vo Acad Sci USSR, Moscow-Leningrad, 1949.

CONFIDENTIAL

CONFIDENTIAL

Sanitized Copy Approved for Release 2011/09/08 : CIA-RDP80-00809A000600300411-1

CONFIDENTIAL

CONFIDENTIAL

50X1-HUM

4. Malyuzhinets, G. D., DAN, Vol LIV, 403 (1946).

5. Rozenberg, L. D., DAN, Vol LVII, 347 (1947).

6. Rozenberg, L. D., ZhTF, Vol XVIII, 11 (1948).

7. Tartakovskiy, B. D., DAN, Vol LXIX, 29 (1949).

- E N D -

CONFIDENTIAL

CONFIDENTIAL

Sanitized Copy Approved for Release 2011/09/08 : CIA-RDP80-00809A000600300411-1